Serum concentrations of legacy and emerging halogenated flame retardants in a Norwegian cohort: Relationship to external exposure

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ABSTRACT

Sixty-one serum samples from a Norwegian cohort were analyzed for 43 emerging and legacy halogenated flame retardants (HFRs). BDE-47, -153, −197 and −209 were detected in >56% of the samples with median concentrations of 0.23, 1.0, 0.64 and 1.5 ng/g lipid, respectively. BDE-49, -85, −99, −100, −154, −206, −207, −208 as well as HBB, *syn*- and *anti*-DDC-CO, OBTMPI, DBDPE, α-HBCDD and TBBPA were also detected in some serum samples (detection frequencies of 2–36%). Other tri-octaBDEs, TBP-AE, α- and β-DBE-DBCH, BATE, pTBX, αβ-TBCO, PBBz, TBCT, PBT, PBEB, DPTE, EH-TBB, BTBPE, BEH-TEBP, HCDBCO, β- and γ-HBCDD were below the limits of detection (mLOD). Concentrations of individual BDE congeners detected in this study were within the range from previous European studies. Positive correlations were seen between concentrations of BDE-47 in dust and BDE-153 in serum, between BDE-153 in dust and BDE-153 in serum, and between BDE-153 masses in handwipes and BDE-47 concentrations in serum (Spearman's rank, $0.29 < r < 0.43$). Associations between the number of phones/mobiles, numbers of electronic equipment per person in the home and the consumption of specific food categories (such as soups/spices/sauces and alcoholic beverages) with BDE-47 and -153 serum levels were confirmed by multivariate linear regression analyses. The measured median serum level of BDE-47 was slightly over-predicted by a factor of 5.5 whereas other BDE congeners were under-predicted by factors of 13–6000 when compared to serum concentrations predicted from external exposure media (inhalation, dermal uptake, dietary intake from duplicate diet and dust ingestion) using a simple one compartment pharmacokinetic (PK) model. BDE-153 was not detected and BDE-197 not analyzed in food so no dietary intake assessments for these could be made, which may partially explain the discrepancies between their measured and predicted serum concentrations. Overall, our results suggest that exposure via diet is the most important exposure pathway for BDE-47 and -209, with diet being

responsible for more than 96% of the total daily intake of these two BDEs in the Norwegian cohort.

KEYWORDS:

PBDEs; Flame retardants; Serum; Diet; Exposure

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